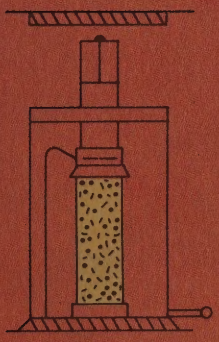
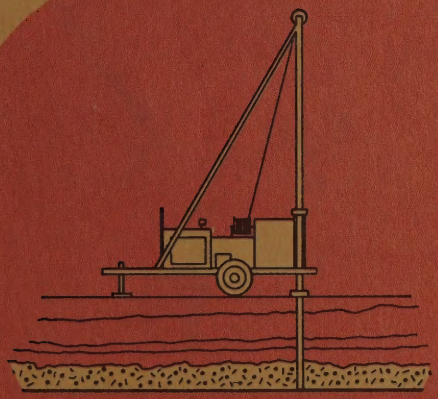
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS
BUREAU





OVERLAY THICKNESS DETERMINATION

PIN 7720.21 and 7720.22
Interstate 87
Clinton County

June 24, 1970

SM 238a (1/69)

Original → File

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE June 24, 1970

SUBJECT PROJECTS NO. 7720.21, 7720.22, I-87 ESSEX CO. LINE TO CANADIAN BORDER, CLINTON COUNTY, TRANSMITTAL OF REPORT "OVERLAY THICKNESS DETERMINATION"

FROM Wm. P. Hofmann, Soil Mechanics Bureau, Room 102, Bldg. 7
By R. J. Weaver

TO M. D. Graham, Facilities Design Subdivision, Room 404, Bldg. 5

cc R. H. Edwards, Prelim. Plan Review Bureau, Room 408. Bldg. 5
C. J. Lyman, Region 7
G. W. McAlpin, Technical Services Subdivision, Room 213, Bldg. 7
W. C. Burnett, Engineering Research and Development Bureau, First Floor, Wolf Road
F. W. Memmott, Program Analysis Bureau, Room 310, Bldg. 5

Transmitted herewith is the above report prepared in accordance with the request of former Regional Director, A. H. Emery, dated March 17, 1970.

In addition to the computations made in order to determine the required overlay thickness, this report contains:

1. The tabulated results of a pavement condition survey performed by the Soil Mechanics and Engineering Research and Development Bureaus with the cooperation of Region 7 personnel, and

2. A traffic analysis prepared by D. A. Graudons of the Program Analysis Bureau.

The pavement condition survey reveals that only the southernmost portion (FISH 61-8) of this section of I-87 has a Present Serviceability Index (PSI) of less than 2.5. However, a comparison of the PSI values obtained this year for several other portions with those obtained in 1966 indicates that the condition of the pavement has been deteriorating rapidly and will reach a PSI of 2.5 within 1 to 5 years.

Based on the results of the pavement condition survey and on our computations, we recommend that:

1. Contracts FISH 58-25 (7145.00), FISH 61-5, and FISH 61-8 be resurfaced immediately using 2½ inches of Item 51F, Asphalt Concrete-Type 1A (Mixing Method-Two Course).

NYSDOT
Library
50 Wolf Road, POD 34
Albany, New York 12232

2. Contracts FISH 60-10 and FISH 60-14 be resurfaced in 1971 and 1972 using the above overlay.

3. A pavement condition survey be made in 1973 or 1974 to investigate the serviceability of Contracts FISH 59-2 and FISH 60-15. Our computations indicate that Contract FISH 59-2 will require an overlay as described above in 1975.

Enc.
RJW:ARS:DAS

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Traffic Analysis.....	12-27

NEW YORK STATE
DEPARTMENT OF TRANSPORTATION

Inter-Office Correspondence

To: Building 7 Room 102
William P. Hofmann Director, Soils Mechanics Bureau

Date: March 17, 1970

From: A. H. Emery, Acting Regional Director, Region #7

Subject: Interstate System Pavement Evaluation

In accordance with IM 21-1-67 and a letter to Reg. Transport Directors dated November 17, 1969 from J. K. Mladinov, we respectfully request a pavement design analysis on the following projects.

Route 87I FAI 502
Essex-Clinton County
Line Northward 14.0 Miles
to Section 7B-2
Clinton County
Resurfacing
PIN 772022-101

Route 87I FAI 502
North of Section 7B-2
Thence Northerly 16.8
Miles to Sect. 7D2
Clinton County
Resurfacing
PIN 772021-101

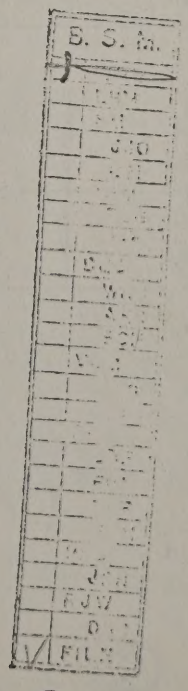
Although the scheduled start of preliminary plans is in June 1970, we would hope to accomplish this work as soon as your evaluation is received and approved by the Bureau of Public Roads. (PS&E = Oct. 1970)

Thank you.

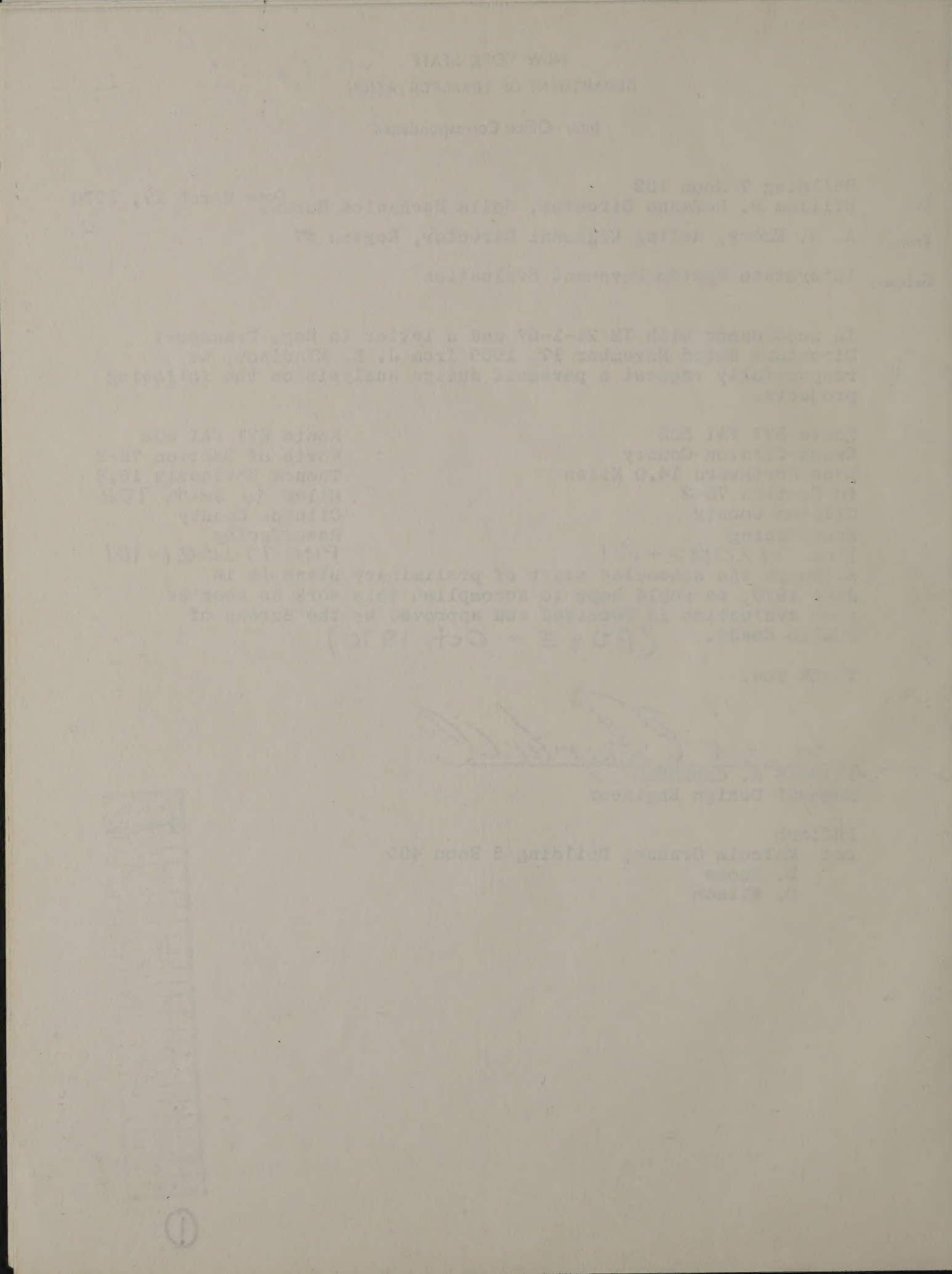
Francis R. Campbell

FRANCIS R. CAMPBELL
Regional Design Engineer

FRC:emb
cc: Malcolm Graham, Building 5 Room 405
E. Hoose
D. Wilson



(1)



SUMMARY OF PAVEMENT SERVICEABILITY SURVEY
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
BUREAU OF SOIL MECHANICS
MAY 1970

P I N	Contract Number	Limits of area tested or pavement test section number	Results of Measurements Performed by Engineering Research and Development Bureau on Pavement Test Sections									Year in which pavement will reach PSI=2.5 assuming a constant rate of decrease in PSI since 1966	Present serviceability Rating (PSR) by a panel of raters 1970
			Roughness (R) in inches/mile			Average Rut Depth (RD) in inches			Cracking and Patching (C&P) in feet/1000 sq. ft.			Present Serviceability Index (PSI)[a]				
			1966	1969	1970	1966	1969	1970	1966	1969	1970	1966	1969	1970		
7720.22	FISH 61-8	71-25	74.5		100.8	.100		.167	8.8		174.3	3.48		2.31	1969	
		Entire Project			103.2											3.2
	FISH 61-5	Entire Project			104.8											3.2
	FISH 59-2	71-21-66	64.8		88.0	.067		.198	1.5		2.6	3.86		3.08	1975	
		Entire Project														3.4
7141.00	FISH 58-23[b]	71-20		92.6[c]			.156[c]			.6[c]			3.19[c]			
				91.8[d]	78.9		.004[d]	.091		0[d]	2.1		3.48[d]	3.53		
		71-21-69		106.2[c]			.206[c]			1.7[c]			2.79[c]			
				77.5[d]	67.2		0[d]	.095		0[d]	0.5		3.75[d]	3.81		
		Mean												3.67		
		Entire Project														4.1
	FISH 58-23 (Ramps)	Interchange 37 NB on Ramp														4.0
		Interchange 38														3.1
		Interchange 39														3.5
7720.21	FISH 60-15	71-24-1	78.5		69.8	.120		.161	0		2.0	3.59		3.54	1990	
		71-24-2	76.5		78.2	.156		.154	0		16.8	3.54		3.21		
		Mean										3.56		3.38		
		Entire Project														3.2
	FISH 60-14	71-23-1	70.3		114.2	.040		.043	.2		1.9	3.85		2.99	1972	
		71-23-2	71.0		106.4	.100		.175	0		4.3	3.78		2.70		
		Mean										3.82		2.84		
		Entire Project														3.1
	Removed FISH 60-10	71-22-1	68.6		112.8	.166		.178	0		2.5	3.66		2.71	1971	
		71-22-2	68.2		111.3	.214		.264	0		.1	3.49		2.56		
		Mean										3.58		2.64		
		Entire Project														3.1
7145.00	FISH 58-25	71-28			109.4			.208			8.0			2.65		
		Entire Project			117.1											2.7

a - $\text{Log}_e (PSI) = 1.73 - .00\ 53R - 2.67\ RD^2 - .022\sqrt{C+P}$
b - Armor - coated in 1969
c - Before Armor - coating
d - After Armor - coating

Conclusion, PSI FISH 61-5 & FISH 60-14 is ?

(2)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: Overlay Design I-87 Sheet 1 of 43 Sheets

Prepared by: R. M. Leary Date 6/15/70

AASHO Interim Guides Checked by: R. Newberry Date

Assume Regional Factor of 3.0

Coefficients for SN from AASHO Guides

Item 51 - Asphalt Concrete	0.44
Item 455Y - Asphalt Concrete	0.34
Item 45X - Broken Stone	0.14
Item 39 - Gravel	0.11

FISH 61-8

I - Compute original SN

Item	Thickness	Coefficient	Product
51	2.5	0.44	1.10
455Y	3	0.34	1.02
45X	4	0.14	0.56
39	12	0.11	1.32
			4.00 = SN

II - Compute equivalent daily 18KAL

Total 18KAL = 513,336

Average 18KAL per day = $\frac{513,336}{20(365)} = 70$

III - Determine Soil Support Value

From chart 400-2 S = 3.3

IV - Determine Total Traffic

Total 18KAL = 1,291,304 + 513,336 = ~~1,754,640~~ 1,804,640

Average 18KAL per day = $\frac{1,804,640}{20(365)} = 247$

V - Determine Required SN

From chart 400-1 SN = 4.58

(3)

VI Determine Overlay $\frac{4.58-4.00}{0.44} = 1.32$ use ~~1~~ 1 1/2 inches

SM 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: Overlay Design I-87 Sheet 2 of 43 Sheets

Prepared by: R. M. Leary Date 6/15/70

AASHO Interim Guides Checked by: Date

Alternate Design

IV - Determine Future Traffic

Total 18KAL = 1,291,304

Average 18KAL per day = $\frac{1,291,304}{20(365)} = 177$

V - Determine Required SN

From Chart 400-1 SN = 4.35

V-A - Determine Present SN - Assume Deterioration

Item 51 deteriorates to 0.30
Item 455Y deteriorates to 0.14
Item 45X - No deterioration - 0.14
Item 39 - No deterioration - 0.11

$(2.5)(0.30) = 0.75$
$(7)(0.14) = 0.98$
$(12)(0.11) = 1.32$
$3.05 = SN$

VI - Determine Overlay

$\frac{4.35 - 3.05}{0.44} = 2.95$

~~use 3 inches~~

SM 273 (12/67)

(4)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: Overlay Design I-87 Sheet 3 of 43 Sheets

AASHO Interim Guides Prepared by: R.M. Leary Date 6/15/70

Checked by: Date

FISH 61-5

I - Original SN = 4.00

II - Average 18KAL/day = $\frac{530,214}{20(365)} = 73$

III - Soil Support Value

S = 3.3

IV - Total Traffic

Total = 530,214 + 906,036 = 1,436,250

Ave. 18KAL/day = $\frac{1,436,250}{20(365)} = 197$

V - Required SN = 4.40

VI - overlay $\frac{4.40 - 4.00}{0.44} = 0.91$

Use 2 1/2 inches

Alternate method Not Applicable
Pavement is not seriously cracked

(5)

SM 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: OVERLAY DESIGN I-87 Sheet 1 of 6 Sheets

Prepared by: R. Newberry Date 6-19-70

AASHO INTERIM GUIDES Checked by: A. Schnare Date 6-19-70

FISH 59-2 1975 → PSI = 2.5

PREDICTED TRAFFIC (1975) → 13,400

MEAN AADT (1960-75) = (2,625+13,400)/2 = 8,013

Directional Split (D.S.) = $\frac{8,013}{2}$ = 4,006

D.S. FOR 1963-70 = $\frac{3,105}{501}$ inc IN SPLIT

$\frac{501}{3,105}$ = 29% (PERCENT INC. IN SPLIT)

221.69 ADL (1563-1570)

1.29

285.58 ADL (1963-1975)

285.58 $\frac{13}{20}$ = 186 ADL FOR 20 yr. PERIOD

USING DESIGN CHART 400-2 TO FIND SOIL SUPPORT VALUE (S)

S = 3.8

USING NEW TRAFFIC DATA

PREDICTED 1979 = 15,750

MEAN AADT (1960-79) = (2,625+15,750)/2 = 9,188

D.S. = $\frac{9,188}{2}$ = 4,594

6,563

4,594

1,969 dec in SPLIT

SM 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: OVERLAY DESIGN I-87 Sheet 2 of 6 Sheets

Prepared by: R. Newberry Date

AASHO INTERIM GUIDES Checked by: A. Schnorr Date

FISH 55-2
CONT $\frac{1,969}{6,563} = 30\ \%$ PERCENT DEC.

429 ADL (1971-1979)

.70

~~+~~ 300 ADL (1960-1979)

USING DESIGN CHART 400-1 TO DETERMINE SN VALUE

$SN = 4.4$

$SN = a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4$

$a_2D_2 = 1.02$

$a_3D_3 = 0.56$

$a_4D_4 = 1.32$

2.90

$D_1 = \frac{4.4 - 2.90}{.44}$

$D_1 = 3.41$

overlay $= 3.41 - 2.50$

OVERLAY = .91"

Use 2 1/2 inches

SM 273 (12/67)

(7)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: OVERLAY DESIGN I-87 Sheet 3 of 6 Sheets

Prepared by: R. Newberry Date 6-19-70

AASHO INTERIM GUIDES Checked by: A. Schnore Date 6-19-70

FISH 60-10 1971 → PSI = 2.5

PREDICTED TRAFFIC (1971) = 6,250

MEAN AADT (1962-71) = (3,608 + 6,250)/2 = 4,929

D.S. = $\frac{4,929}{2}$ = 2,465

D.S 1962-70 = 2,427

38 inc.

$\frac{38}{2,427}$ = 2% inc

173.23 ADL 1962-1970

1.02

176.69 ADL 1962-71

176.69 $\frac{10}{20}$ = 88 ADL FOR 20 yr. PERIOD

USING DESIGN CHART NO. 400-2
TO DETERMINE (S)

S = 3.0

USING NEW TRAFFIC DATA

PREDICTED TRAFFIC 1980 = 10,650

MEAN AADT (1962-1980) = (3,608 + 10,650)/2 = 7,129

D.S. = 7,129 - 3,565

D.S. (1971-80) = 4,289

724 dec.

$\frac{724}{4289}$ = 17% dec.

SM 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: OVERLAY DESIGN I-87 Sheet 4 of 6 Sheets

Prepared by: R. NEWBERRY Date

AASHO INTERIM GUIDES Checked by: A. Schmore Date

FISH 60-10 CONT.

280.72 ADL (1971-80)

1.83

233 ADL (1962-80)

$233 \frac{19}{20}$ = 221 ADL FOR 20yr. PERIOD

USING DESIGN CHART 400-1 TO DETERMINE SN VALUE

SN = 4.07

$SN = a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4$

a_2D_2 = 1.05

a_3D_3 = 0.56

a_4D_4 = 1.32

$D_1 = \frac{4.7 - 2.90}{.44}$

D_1 = 4.09

OVERLAY = 4.09 − 2.50 = 1.59"

OVERLAY = 1.59"

Use 2 1/2 inches

(9)

SM 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: OVERLAY DESIGN I-87 Sheet 5 of 6 Sheets

Prepared by: R. Newberry Date 6-19-70

AASHO INTERIM GUIDES Checked by: A. Schnore Date 6-19-70

FISH 60-14 1972 → PSI = 2.5

PREDICTED TRAFFIC #(1972) = 8,400

MEAN AADT (1963-72) = (3,800 + 8,400)/2 = 6,100

D.S. = $\frac{6,100}{2}$ = 3,050

D.S. 1963-70 = 2,724

326 inc in SPLIT

$\frac{326}{2,724}$ = 12% inc.

194.53 ADL 1963-70

1.12

217.87 ADL 1963-72

217.87 $\frac{10}{20}$ = 109 ADL FOR 20yr. PERIOD

USING DESIGN CHART NO. 400-2
TO DETERMINE (S)

S = 3.3

USING NEW TRAFFIC DATA

PREDICTED TRAFFIC (1980) = 11,800

MEAN AADT (1963-1980) = (3,800 + 11,800)/2 = 7,800

D.S. = $\frac{7,800}{2}$ = 3,900

D.S (1971-1980) = 4,889

989 dec.

$\frac{989}{4889}$ = 20% dec.

(10)

M 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: OVERLAY DESIGN I-87 Sheet 6 of 6 Sheets

Prepared by: R. Newberry Date

AASHO INTERIM GUIDES Checked by: A. Schnore Date

FISH 60-14

CONT. 320 ADL 1971-1980

$\frac{.8}{256}$ ADL FOR 1963-1980

$256\left(\frac{9}{10}\right) = 230.4$ ADL FOR 20 yr. PERIOD

USING DESIGN CHART 400-1
TO DETERMINE SN VALUE

$SN = 4.5$

$SN = a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4$

$a_2D_2 = 1.02$

$a_3D_3 = 0.56$

$a_4D_4 = 1.32$

$\frac{4.5 - 2.90}{.44} = D_1$

$D_1 = \#\ 3.64$

OVERLAY = $3.64 - 2.50 = 1.14$"

OVERLAY = 1.14"

Use 2 ½ inches

SM 273 (12/67)

(11)

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE May 6, 1970

SUBJECT PROJECT 7720-22-101 and 7720-21-101
I-87 - CLINTON COUNTY
PAVEMENT ANALYSIS

FROM J. Sternbach, Program Analysis Bureau, Bldg. 5, Room 301 JS

TO W. P. Hofmann, Soil Mechanics Bureau, Bldg. 7

CC M. D. Graham, Highway Design & Const. Subdiv., Bldg. 5, Room 404

To assist you in the preparation of the Pavement Design Analysis for the subject projects, we are enclosing two copies of the necessary traffic analysis.

In summary our analysis reveals the following results:

P = 2.5 SN = 4.3

Section	Years	ADL	No.of Years	Total 18,000# Axle Loads
B23.0.2-C2.1	1963-1970	175.80	8	513,336
C2.1-C3	1963-1970	181.58	8	530,214
C3-C5	1960-1970	221.69	11	890,085
C6.1-C7.1	1963-1970	194.53	8	568,028
C7.1-C7.1+	1962-1970	173.23	9	569,061

P = 2 SN = 5

Section	Years	ADL	No.of Years	Total 18,000# Axle Loads
B23.0.2-C2.1	1971-1981	321.62	11	1,291,304
C2.1-C3	1971-1979	275.81	9	906,036
C3-C5	1971-1979	429.66	9	1,411,433
C6.1-C7.1	1971-1981	320.00	10	1,168,000
C7.1-C7.1+	1971-1980	280.72	10	1,024,628

JS:DAG:NCS

Enclosures (2)

S. S. M.
LHM
SM
JJO
BM
RSG
ASE
VCM
JFF
FRI
EAF
FRM
PHS
JRH
RJW
FILE

(12)

4/30/70
Compiled by D. Graudons

TRAFFIC DATA FOR DETERMINATION
OF OVERLAY THICKNESS

Project

Interstate Route I-87
Clinton County
PIN 7720-22-101, PIN 7720-21-101

Project Location: 7720-22-101

This project begins just south of the Essex-Clinton County Line on I-87 at Point B23.0.2 and runs northerly to Point C5.

Project Location: 7720-21-101

This project begins at Point C6.1 on I-87 and runs northerly for a distance of 16.8 miles.

General Information

Reference, BPR circular memorandum dated May 9, 1967 from G. M. Williams.

The applicable design periods and design years, for the pavement structure, for these estimate section types are restated hereafter:

(a) N/A
(b) Projects constructed with FAI funds for which the pavement construction was authorized prior to October 24, 1963

The design period is twenty years after the date of authorization for construction of the initial pavement construction project. Etc.

(c) N/A
(d) N/A

Reference, March 19, 1969 memorandum from G. M. Williams.

Establish Traffic Data For The Following:

(a) The total equivalent 18-Kip single axle load application that will have passed over the traffic lane of the pavement structure during the period of time from its initial opening to traffic to the date when the service ability index (P_t) will be 2.5 and the overlay is to be placed.

(b) The total equivalent 18-Kip single axle load applications that will have passed over the traffic lane of the pavement structure during the period of time from its initial opening to traffic to the time that the pavement on which an overlay has been placed will have a service ability index (P_t) of 2.0, which traffic and time period are represented in design at least by a twenty year design period.

Identify Sections: (Data From Table AW-2)

Project	Section	Pavement Authorization	Pavement Open To Traffic	Pavement Design Year By Law	Mileage
7720.22	B23.0.2-C2.1	1961	1963	1975	10.5
7720.22	C2.1-C3	1959	1963	1975	1.6
7720.22	C3-C5	1959	1960	1975	2.5
7720.21	C6.1-C7.1	1960	1963	1975	11.4
7720.21	C7.1-C7.1+	1960	1962	1975	5.4

Lane Distribution

Reference: Highway Capacity Manual, page 106 "On Upgrades . . . most of the trucks stay in Lane 1, ..."

Assumptions: Ninety-five per cent of the lighter trucks use Lane 1. One-hundred per cent of the heavier trucks use Lane 1. Since passenger cars have little effect on pavement design, assume forty per cent in Lane 1 and sixty per cent in Lane 2.

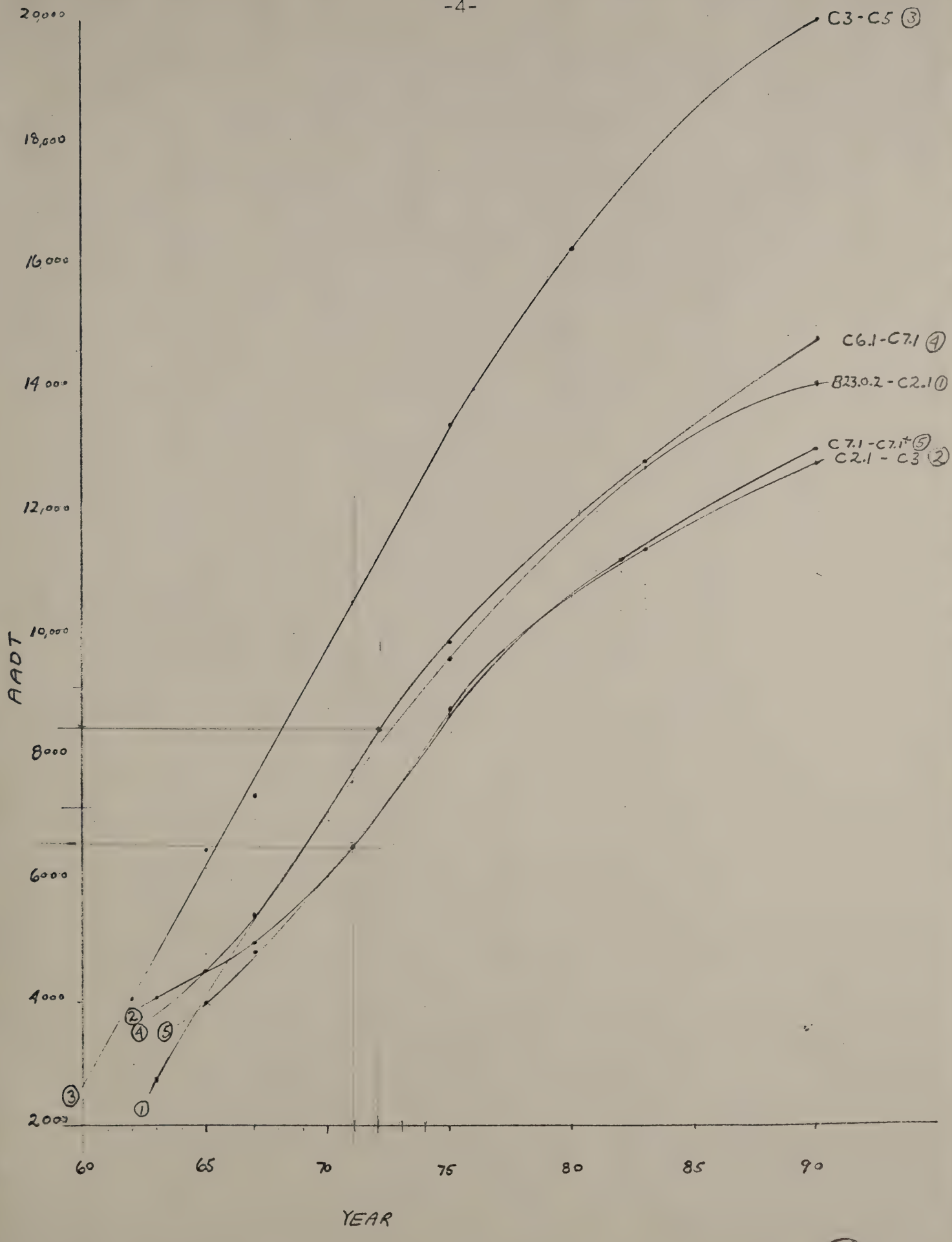
BASIC TRAFFIC DATA FROM VARIOUS INTERSTATE COST ESTIMATES
AADT

Section	Year Open To Traffic	AADT* Year Open To Traffic	1962	1965	1967	1975	1990
B23.0.2-C2.1	1963	2,750	--	3,918	5,460	9,600	14,100
C2.1-C3	1963	4,075	--	4,562	4,980	8,800	12,800
C3-C5	1960	2,625	4065	6,529	7,380	13,400	20,000
C6.1-C7.1	1963	3,800	--	4,502	5,460	9,900	14,800
C7.1-C7.1+	1962	3,608	3608	4,009	4,820	8,700	13,000

*From Plot of AADT vs. Year (using above data)

FROM PLOT OF AADT VS. YEAR

Section	Traffic Design Year	Design Year Traffic	Year P= 2.5	Traffic 1970	Traffic 1971
B23.0.2-C2.1	1981	12,050	1970	7,100	7,600
C2.1-C3	1979	10,350	1970	6,100	6,500
C3-C5	1979	15,750	1970	9,800	10,500
C6.1-C7.1	1980	11,800	1970	7,100	7,750
C7.1-C7.1+	1980	10,650	1970	6,100	6,500


20,000
18,000
16,000
14,000
12,000
10,000
8000
6000
4000
2000
AADT
60
65
70
75
80
85
90
YEAR
C3 - C5 (3)
C6.1 - C7.1 (4)
B23.0.2 - C2.1 (1)
C 7.1 - C7.1* (5)
C2.1 - C3 (2)
(1)
(2)
(3)
(4)
(5)

DATA FROM TABLE W-1 OF 1968 TRUCK WEIGHT STUDY FOR STATION No. 782

ASSUMPTION: 1968 IS A REPRESENTATIVE YEAR

Vehicle Type	1968 Count	% of Total
Passenger Cars	4,173	85.16
Buses	53	1.08
Panels and Pickups	123	2.51
Other 4-Tire Trucks	11	0.23
2-Axle, 6-Tire Trucks	126	2.57
3-Axle Trucks	13	0.27
3-Axle Semi-Trailers	27	0.55
4-Axle Semi-Trailers	144	2.94
5-Axle Semi-Trailers	228	4.65
4-Axle Full Trailers	2	0.04
Total	4,900	100.00

Section B23.0.2-C2.1 P = 2.5 SN 4.3
Mean AADT 1963-1970 = (2,750 + 7,100)/2 = 4,925
Directional Mean AADT = 1/2 (4,925) = 2,463

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1963-1970	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18 Kip Axle Equivs. P = 2.5 SN = 5 (from W-4) Rate/1000 (1966 Data)	Convert to 18 Kip Axle Equivs. P = 2.5 SN = 4.3 (Rate/1000)	ADL
Passenger Cars	85.16	2097	40	839	.8	.9	.76
Buses	1.08	27	95	25	257.0	276.0	6.97
Panels & Pickups	2.51	62	95	59	2.1	2.7	.16
Other 4-Tire Trucks	.23	6	95	5	8.1	9.4	.05
2-Axle, 6-Tire Trucks	2.57	63	95	60	254.0	273.0	16.42
3-Axle Trucks	.27	7	95	6	641.4	656.0	4.14
3-Axle Semi-Trailers	.55	14	100	14	528.3	555.0	7.52
4-Axle Semi-Trailers	2.94	72	100	72	834.1	856.0	61.98
5-Axle Semi-Trailers	4.65	115	100	115	645.7	672.0	76.96
4-Axle Full Trailers	.04	1	100	1	834.1	856.0	.84
Total	100.00	2464		1196			175.80

Total 8-year 18,000 Lb. axle loading = 175.80 (365) (8) = 513,336
Years 1963-1970.

Section C2.1 - C3 P = 2.5 SN = 4.3
Mean AADT 1963-1970 = (4075 + 6100)/2 = 5088
Directional Mean AADT = 1/2 (5088) = 2544

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1963-1970	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18 Kip Axle Equivs. P = 2.5 SN = 5 (from W-4) Rate/1000 (1966 Data)	Convert to 18 Kip Axle Equivs. P = 2.5 SN = 4.3 (Rate/1000	ADL
Passenger Cars	85.16	2166	40	867	.8	.9	.78
Buses	1.08	27	95	26	257.0	276.0	7.20
Panels & Pickups	2.51	64	95	61	2.1	2.7	.16
Other 4-Tire Trucks	.23	6	95	6	8.1	9.4	.05
2-Axle, 6-Tire Trucks	2.57	65	95	62	254.0	273.0	16.96
3-Axle Trucks	.27	7	95	7	641.4	656.0	4.28
3-Axle Semi-Trailers	.55	14	100	14	528.3	555.0	7.77
4-Axle Semi-Trailers	2.94	75	100	75	834.1	856.0	64.02
5-Axle Semi-Trailers	4.65	118	100	118	645.7	672.0	79.49
4-Axle Full Trailers	.04	1	100	1	834.1	856.0	.87
Total	100.00	2543		1237			181.58

Total 8-year 18,000 Lb. Axle Loading = 181.58 (365) (8) = 530,214
Years 1963-1970.

Section C3-C5 P = 2.5 SN = 4.3
Mean AADT 1960-1970 = (2625 + 9800)/2 = 6212
Directional Mean AADT = 1/2 (6212) = 3106

Vehicle Type	% from Counts or forecasts	Distrib. of 1/2 AADT 1963-1970	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18 Kip Axle Equivs. P = 2.5 SN = 5 (from W-4) Rate/1000 (1966 Data)	Convert to 18 Kip Axle Equivs. P = 2.5 SN = 4.3 (Rate/1000)	ADL
Passenger Cars	85.16	2645	40	1058	.8	.9	.95
Buses	1.08	34	95	32	257.0	276.0	8.80
Panels & Pickups	2.51	78	95	74	2.1	2.7	.20
Other 4-Tire Trucks	.23	7	95	7	8.1	9.4	.06
2-Axle, 6-Tire Trucks	2.57	80	95	76	254.0	273.0	20.70
3-Axle Trucks	.27	8	95	8	641.4	656.0	5.22
3-Axle Semi-Trailers	.55	17	100	17	528.3	555.0	9.48
4-Axle Semi-Trailers	2.94	91	100	91	834.1	856.0	78.17
5-Axle Semi-Trailers	4.65	144	100	144	645.7	672.0	97.05
4-Axle Full Trailers	.04	1	100	1	834.1	856.0	1.06
Total	100.00	3105		1508			221.69

Total 11-year 18,000 Lb. Axle Loading = 221.69 (365) (11) = 890,085
Years 1960-1970.

Section C6.1-C7.1 P = 2.5 SN = 4.3
Mean AADT 1963-1970 = (3800 + 7100)/2 = 5450
Directional Mean AADT = 1/2 (5450) = 2725

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1963-1970	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18 Kip Axle Equivs. P = 2.5 SN = 5 (from W-4) Rate/1000 (1966 Data)	Convert to 18 Kip Axle Equivs. P = 2.5 SN = 4.3 (Rate/1000)	ADL
Passenger Cars	85.16	2321	40	928	.8	.9	.84
Buses	1.08	29	95	28	257.0	276.0	7.72
Panels & Pickups	2.51	68	95	65	2.1	2.7	.18
Other 4-Tire Trucks	.23	6	95	6	8.1	9.4	.06
2-Axle, 6-Tire Trucks	2.57	70	95	66	254.0	273.0	18.16
3-Axle Trucks	.27	7	95	7	641.4	656.0	4.59
3-Axle Semi-Trailers	.55	15	100	15	528.3	555.0	8.32
4-Axle Semi-Trailers	2.94	80	100	80	834.1	856.0	68.58
5-Axle Semi-Trailers	4.65	127	100	127	645.7	672.0	85.15
4-Axle Full Trailers	.04	1	100	1	834.1	856.0	.93
Total	100.00	2724		1323			194.53

Total 8-year 18,000 Lb Axle Loading = 194.53 (365) (8) = 568,028
Years 1963-1970.

Section C7.1-C71+ P = 2.5 SN = 4.3
Mean AADT 1962-1970 = (3608 + 6100)/2 = 4854
Directional Mean AADT = 1/2 (4854) = 2427

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1962-1970	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18 Kip Axle Equivs. P = 2.5 SN = 5 (from W-4) Rate/1000 (1966 Data)	Convert to 18 Kip Axle Equivs. P = 2.5 SN = 4.3 (Rate/1000)	ADL
Passenger Cars	85.16	2067	40	827	.8	.9	.74
Buses	1.08	26	95	25	257.0	276.0	6.87
Panels & Pickups	2.51	61	95	58	2.1	2.7	.16
Other 4-Tire Trucks	.23	6	95	5	8.1	9.4	.05
2-Axle, 6-Tire Trucks	2.57	62	95	59	254.0	273.0	16.18
3-Axle Trucks	.27	7	95	6	641.4	656.0	4.08
3-Axle Semi-Trailers	.55	13	100	13	528.3	555.0	7.40
4-Axle Semi-Trailers	2.94	71	100	71	834.1	856.0	61.08
5-Axle Semi-Trailers	4.65	113	100	113	645.7	672.0	75.84
4-Axle Full Trailers	.04	1	100	1	834.1	856.0	.83
Total	100.00	2427		1178			173.23

Total 9-Year 18,000 Lb. Axle Loadings = 173.23 x 365 x 9 = 569,061
Years 1962-1970

Section B23.0.2-C2.1 P = 2 SN = 5
Mean AADT 1971-1981 = (12050 + 7600)/2 = 9825
Directional Mean AADT = 1/2 (9825) = 4913

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1971-1981	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18K Axle Equiv. P = 2.5 SN = 5 From W-4 Rate/1000 1966 Data	Convert to 18K Axle Equiv. P = 2.0 SN = 5 (Rate/1000)	ADL
Passenger Cars	85.16	4184	40	1674	.8	.7	1.17
Buses	1.08	53	95	50	257.0	239.0	12.04
Panels & Pickups	2.51	123	95	117	2.1	1.8	.21
Other 4-Tire Trucks	.23	11	95	11	8.1	7.2	.08
2-Axle, 6-Tire Trucks	2.57	126	95	120	254.0	236.0	28.31
3-Axle Trucks	.27	13	95	13	641.4	622.0	7.83
3-Axle Semi-Trailers	.55	27	100	27	528.3	499.0	13.48
4-Axle Semi-Trailers	2.94	144	100	144	834.1	806.0	116.42
5-Axle Semi-Trailers	4.65	228	100	228	645.7	615.0	140.50
4-Axle Full Trailers	.04	2	100	2	834.1	806.0	1.58
Total	100.00	4911		2386			321.62

Total 11-Year18,000 Lb. Axle Loadings = 11 (365) (321.62) = 1,291,304
Years 1971-1981

Section C2.1-C3 P = 2 SN = 5
Mean AADT 1971-1979 = (10,350 + 6500)/2 = 8425
Directional Mean AADT = 1/2 (8425) = 4213

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1971-1979	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18K Axle Equivs. P = 2.5 SN = 5 (from W-4) Rate/1000 1966 Data	Convert to 18K Axle Equivs. P = 2.0 SN = 5 Rate/1000	ADL
Passenger Cars	85.16	3588	40	1435	.8	.7	1.00
Buses	1.08	46	95	43	257.0	239.0	10.33
Panels & Pickups	2.51	106	95	100	2.1	1.8	.18
Other 4-Tire Trucks	.23	10	95	9	8.1	7.2	.07
2-Axle, 6-Tire Trucks	2.57	108	95	103	254.0	236.0	24.28
3-Axle Trucks	.27	11	95	11	641.4	622.0	6.72
3-Axle Semi-Trailers	.55	23	100	23	528.3	499.0	11.56
4-Axle Semi-Trailers	2.94	124	100	124	834.1	806.0	99.83
5-Axle Semi-Trailers	4.65	196	100	196	645.7	615.0	120.48
4-Axle Full Trailers	.04	2	100	2	834.1	806.0	1.36
Total	100.00	4214		2046			275.81

Total 9-Year 18,000 Lb. Axle Loadings = 9 (365) (275.81) = 906,036
Years 1971-1979

Section C3-C5 P = 2 SN = 5
Mean AADT 1971-1979 = (15,750 + 10,500)/2 = 13,125
Directional Mean AADT = 1/2 (13125) = 6563

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1971-1979	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18K Axle Equivs. P = 2.5 SN = 5 from W-4 Rate/1000 1966 Data	Convert to 18K Axle Equivs. P = 2.0 SN = 5 Rate/1000	ADL
Passenger Cars	85.16	5589	40	2236	.8	.7	1.56
Buses	1.08	71	95	67	257.0	239.0	16.09
Panels & Pickups	2.51	165	95	156	2.1	1.8	.28
Other 4-Tire Trucks	.23	15	95	14	8.1	7.2	.10
2-Axle, 6-Tire Trucks	2.57	169	95	160	254.0	236.0	37.82
3-Axle Trucks	.27	18	95	17	641.4	622.0	10.47
3-Axle Semi-Trailers	.55	36	100	36	528.3	499.0	18.01
4-Axle Semi-Trailers	2.94	193	100	193	834.1	806.0	155.52
5-Axle Semi-Trailers	4.65	305	100	305	645.7	615.0	187.69
4-Axle Full Trailers	.04	2	100	2	834.1	806.0	2.12
Total	100.00	6563		3186			429.66

Total 9-Year 18,000 Lb. Axle Loadings = 9 (365) (429.66) = 1,411,433
Years 1971-1979

Section C6.1 - C7.1 P = 2 SN = 5
Mean AADT 1971-1980 = (11,800 + 7750)/2 = 9775
Directional Mean AADT = 1/2 (9775) = 4888

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1971-1980	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18K Axle Equivs. P = 2.5 SN = 5 from W-4 Rate/1000 1966 Data	Convert to 18K Axle Equivs. P = 2.0 SN = 5 Rate/1000	ADL
Passenger Cars	85.16	4163	40	1665	.8	.7	1.16
Buses	1.08	53	95	50	257.0	239.0	11.99
Panels & Pickups	2.51	123	95	117	2.1	1.8	.21
Other 4-Tire Trucks	.23	11	95	11	8.1	7.2	.08
2-Axle, 6-Tire Trucks	2.57	126	95	119	254.0	236.0	28.16
3-Axle Trucks	.27	13	95	13	641.4	622.0	7.80
3-Axle Semi-Trailers	.55	27	100	27	528.3	499.0	13.41
4-Axle Semi-Trailers	2.94	144	100	144	834.1	806.0	115.83
5-Axle Semi-Trailers	4.65	227	100	227	645.7	615.0	139.78
4-Axle Full Trailers	.04	2	100	2	834.1	806.0	1.58
Total	100.00	4889		2375			320.00

Total 10-Year 18,000 Lb. Axle Loadings = 10 (365) (320) = 1,168,000
Years 1971-1980

Section C7.1-C7.1+ P = 2 SN = 5
Mean AADT 1971-1980 = (10,650 + 6500)/2 = 8575
Directional Mean AADT = 1/2 (8575) = 4288

Vehicle Type	% from Counts or fore-casts	Distrib. of 1/2 AADT 1971-1980	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18K Axle Equivs. P = 2.5 SN = 5 from W-4 Rate/1000 1966 Data	Convert to 18K Axle Equivs. P = 2.0 SN = 5 Rate/1000	ADL
Passenger Cars	85.16	3652	40	1461	.8	.7	1.02
Buses	1.08	46	95	44	257.0	239.0	10.51
Panel & Pickups	2.51	108	95	102	2.1	1.8	.18
Other 4-Tire Trucks	.23	10	95	9	8.1	7.2	.07
2-Axle, 6-Tire Trucks	2.57	110	95	105	254.0	236.0	24.71
3-Axle Trucks	.27	12	95	11	641.4	622.0	6.84
3-Axle Semi-Trailers	.55	24	100	24	528.3	499.0	11.77
4-Axle Semi-Trailers	2.94	126	100	126	834.1	806.0	101.61
5-Axle Semi-Trailers	4.65	199	100	199	645.7	615.0	122.63
4 Axle Full Trailers	.04	2	100	2	834.1	806.0	1.38
Total	100.00	4289		2083			280.72

Total 10-Year 18,000 Lb. Axle Loadings = 10 (365) (280.72) = 1,024,628
Years 1971-1980

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